

TANNIN FROM LOCAL *RHIZOPHORA MUCRONATA* BARKS AS
DEFLOCCULANT IN DRILLING FLUIDS

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“My dearest daddy, mum, family, lecturers and friends”

This is for all of you.

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ABSTRACT

Optimization of drilling fluids is required to make sure the drilling fluids performance is at its best. There are few elements in drilling fluids that can be optimized and one of it is dispersant. Dispersant in general substances added to the suspension to improve separation and also prevent it from settling and clumping. In drilling fluids or mud, dispersant were better referred as deflocculant. The major purpose of using deflocculant is to reduce viscosity of drilling fluids and prevent colloid to occur or any sorts of suspension in mud. One possible dispersant or thinner for drilling fluids identified is tannin from bark waste. In this report, the source of tannin is from the bark of *Rhizophora Mucronata* taken from Kuala Sepetang, Perak. The best extraction solvents are methanol and water at 100°C with total extraction time of 3 hours. There are 72.86% of condensed tannin and 0.1085% of hydrolysable tannin in *Rhizophora Mucronata*. Based on the experimental results performance, tannin extracts from *Rhizophora Mucronata* barks work best at temperature ranging from 225°F to 275°F with not more than 8 grams concentration. The plastic viscosity and yield point for tannin show similar results to the industrial tannin at these temperature and gram concentration. Therefore, for this master project it can be concluded that tannin from *Rhizophora Mucronata* is feasible to be used as deflocculant for drilling fluids as its performance is on par with industrial deflocculant.

ABSTRAK

Penambahbaikan bagi bendalir penggerudian diperlukan bagi memastikan prestasi bendalir penggerudian sentiasa terbaik. Terdapat beberapa elemen didalam bendalir penggerudian yang menjalani penambahbaikan, antaranya ialah penyahsebaran. Penyahsebaran merupakan bahan yang ditambah ke campuran bendalir penggerudian bagi meningkatkan lagi proses pemisahan dan juga menghalang berlakunya mendapan dan gumpalan. Dalam konteks bendalir penggerudian, bahan ini lebih dikenali sebagai penyahgumpalan. Tujuan utama penggunaan penyahgumpalan ini adalah untuk mengurangkan kelikatan bendalir penggerudian dan juga menghalang penggumpalan untuk berlaku di dalam campuran bendalir penggerudian. Dalam kajian ini, sumber yang digunakan adalah dari spesis *Rhizophora Mucronata* daripada Kuala Sepetang. Metanol dan air telah dikenalpasti sebagai pelarut yang paling efektif dengan suhu 100°C selama 3 jam. Terdapat 72.86% adalah tannin pekat manakala 0.1085% adalah tannin terhidrolisis di dalam spesies *Rhizophora Mucronata*. Berdasarkan hasil ujian, ia dapat dikenalpasti bahawa tannin dari *Rhizophora Mucronata* dapat berfungsi sebagai penyahgumpalan bagi bendalir penggerudian dengan suhu bermula dari 225°F hingga 275°F dan had berat sebanyak 8 grams. Kelikatan plastik dan tahap alah menunjukkan prestasi yang sama dengan penyahgumpalan yang digunakan dalam industri pada suhu dan kepekatan grams tersebut. Oleh itu, bagi projek ini tannin dari *Rhizophora Mucronata* dikenal pasti standing dengan penyahgumpalan yang digunakan dalam industri.

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LIST OF ABBREVIATIONS

| | | |
|-----|---|--------------------------------|
| AHR | - | After hot-rolled |
| BHR | - | Before hot-rolled |
| CT | - | Condensed tannin |
| HCL | - | Hydrochloric acid |
| HT | - | Hydrolysable tannin |
| PV | - | Plastic viscosity |
| PWE | - | Pressurised water extraction |
| RBF | - | Round bottom flask |
| RPM | - | Revolution per minute |
| SI | - | Stiasy index |
| SE | - | Soxhlet extraction |
| SFE | - | Supercritical fluid extraction |
| YP | - | Yield point |

LIST OF SYMBOLS

| | | |
|----------------|---|------------------------|
| θ_{300} | - | Dial reading at 300rpm |
| θ_{600} | - | Dial reading at 600rpm |

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CHAPTER 1

INTRODUCTION

1.1 Research Background

This research is mainly focusing on the evaluation of natural and organic tannin extracts obtained from natural source *Rhizophora Mucronata* barks as deflocculant in drilling fluids and comparison with the commercially used deflocculant (desco deflocculant) available in oil and gas industry. The extractions of tannins were carried out using the Soxhlet standard procedures using four different solvents, which are acetone, toluene, water and methanol with 100% concentration respectively. Based on the experiment results, it is found that the most suitable solvents are methanol and water. Tannins extracts from *Rhizophora Mucronata* barks were then categorized as condensed tannins (CT) and Hydrolysable Tannins (HT). Further elaboration on the extraction process and analysis of CT and HT can be found in this research. Tannin extracted then brought to test for its effects on drilling fluids. The extracted tannins is identified to work as efficient as desco deflocculant in terms of treating the flocculation problem based on the viscosity, plastic viscosity (PV), yield point (YP) and gel strength. Details on the findings can be found through this research. Further research should be done to commercially use tannin extracts from *Rhizophora Mucronata* as industrial deflocculant.

1.2 Problem Statement

There are vast challenges that is related to the drilling fluid. Among the major problems are loss of circulation, stuck pipe, barite sag, shale instability and many more. These problems are related to one another thus making the designing of the drilling-fluid system vital. There are so many factors affecting the drilling fluid systems, one of it is flocculation. Flocculation is a situation where formation of particle associations in a suspension creating a gel-like system of drilling fluid. Flocculation problem is often encountered during the discharging of the drilling fluids both during short-term and long-term transport processes during the pumping process. Short term transport includes the initial mixing and passive diffusion of drilling mud plumes (jets) and the initial sedimentation of mud solids. The long-term transport includes the re-suspension, dispersion, and deposition of drilling mud particles over longer periods of time.

Flocculation is not favorable in the industry depending on the situation and cases as it alters the properties of the drilling fluids. Among the properties affected are plastic viscosity, yield point, gel strengths and funnel viscosity as well as increase the fluid loss. Flocculation problems also structurally alters the clay particles in the fluid, which can increase the resistance to flow as they are more structured. Gel-like drilling mud can cause stuck pipe, increase in viscosity thus requires more pump power as well as potentially causing surging. Therefore, flocculation problems must be avoided or fix. One of the way to cater flocculation is by adding the deflocculant additive into the drilling fluid.

There are few types of deflocculant use in the oil and gas industry currently in Malaysia. However, for industrial use deflocculant are mostly imported and being treated by chemicals in order for it to work on desired situation thus it is not environmental friendly. Furthermore, so far there is no locally produced deflocculant in Malaysia and no deflocculant made from the bark waste. Thus, the oil and gas industry in Malaysia is in need of having an environmental friendly deflocculant and locally produced deflocculant would be beneficial in terms of economic growth for our country.

1.3 Project Objective

This research is focusing on the evaluation of the natural tannin extracts obtained from *Rhizophora Mucronata* barks as deflocculant in drilling fluids and comparison with the commercial deflocculant. The main objectives are to:

1. To study the performance of tannin extracts from *Rhizophora Mucronata* barks as deflocculant on drilling fluid at different temperatures.
2. To compare the performance of tannin extracts from *Rhizophora Mucronata* barks to the commercial deflocculant (desco).

1.4 Scope of Study

This study will be govern by these following scope of study.

1. The extraction solvents of tannins from *Bakau Minyak* barks by using soxhlet extraction method and the characterization into condensed tannin (CT) and hydrolyzable tannin (HT).
2. The performance of tannins extracted from *Rhizophora Murconata* barks in drilling fluids and comparison to the commercial deflocculant in industry at different temperature of 225°F, 250°F and 275°F.
3. The amount of tannin added (ranging 2 g to 15 g) to the drilling fluid to find the optimum amount of tannin.

1.5 Significance of The Study

This study open up the possibilities of a new environmental friendly deflocculant to be discovered made from Malaysia's local mangrove bark source that is tannin extracts from *Rhizophora Mucronata* barks. This hopefully will lessen the demands of current commercially used tannins, which is mostly imported from China. This will also flaunt a new business opportunity for the local especially those involved in mangrove and charcoal business. However, a full through out research should be done to achieve such goals.

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